Imports and Plantings of HIGH-YIELDING VARIETIES OF WHEAT AND RICE in the Less Developed Nations

FOREIGN ECONOMIC DEVELOPMENT SERVICE
U.S. DEPARTMENT OF AGRICULTURE IN COOPERATION WITH
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ABSTRACT

The use of high-yielding varieties (HYV) of wheat and rice has expanded sharply in recent years. The purpose of this bulletin is to provide statistical data on imports of seed and area planted in individual nations. There is no one standard definition of high-yielding varieties; this report refers largely to the dwarf and semi-dwarf types of wheat and rice developed, respectively, in Mexico and the Philippines.

Area estimates for free world nations may be summarized as follows (the 1970/71 data are preliminary):

Crop Year	Wheat	Rice	Total
		-- acres --	
1965/66	23,000	18,000	41,000
1966/67	1,542,000	2,505,000	4,047,000
1967/68	10,189,000	6,487,000	16,676,000
1968/69	19,815,000	11,620,000	31,435,000
1969/70	21,551,000	19,104,000	40,655,000
1970/71	25,256,000	25,294,000	50,549,000

Most of the HYV wheat and all of the reported rice area was in South and East Asia; of the 1970/71 total, 58% of the wheat and 54% of the rice was in India. More limited areas of HYV wheat have been planted in West Asia and North Africa. HYV rice has also been planted in Latin America.

In addition to presenting statistical data and accompanying documentation, the report briefly reviews the development of the major wheat and rice varieties. A discussion of rice improvement in three Communist nations in Asia is also included.

KEY WORDS: Wheat, Rice, Green revolution, Seed, Imports (seed), Crop statistics data, Research and development, Asia, Developing nations.

FOREIGN ECONOMIC DEVELOPMENT REPORT–14

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PREFACE

This bulletin is a revised and enlarged version of a report of the same title published in January 1971 as Foreign Economic Development Report 8. Previous statistics have been updated and new estimates are provided for the 1970/71 crop year. The 1970/71 data are preliminary and subject to revision. The report, with one exception, includes information in hand as of January 14, 1972.

Several other changes have also been made. The format of the statistics sections has been rearranged in an effort to facilitate use of notes and references: the information for each country is now grouped together on one or more pages. Some additional countries have been included. Chapters I and II and Table D of Chapter V have been modified somewhat. The Appendix sections were revised only slightly.

As before, the revision has been made possible by the generous cooperation of many individuals, including AID food and agriculture officers, USDA agricultural attaches, Drs. Randolph Barker and T. T. Chang of the International Rice Research Institute, and Dr. Abdul Hafiz of the Food and Agriculture Organization (Cairo).

NOTE

Area conversions on basis of 1 hectare = 2.471 acres.

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Revised February 1972

I. INTRODUCTION

The use of high-yielding semi-dwarf varieties of wheat and rice has expanded sharply in the less developed nations in recent years. This expansion has provided the basis for what is popularly known as the green revolution. The purpose of this report is to document as completely as possible the development and quantitative growth in cultivation of these varieties.

In order to accomplish these purposes, the report is divided into four main chapters. After reviewing definitions, data, and seasons in this chapter, the origin and development of high-yielding varieties is discussed in Chapter II. The heart of the report is set forth in Chapter III, which provides statistics on known imports and plantings for individual countries. The area statistics are summarized in Chapter IV. The development of improved rice varieties in Communist nations (Mainland China, North Korea, and Cuba) is reviewed in an appendix.

Clearly there is much about the high-yielding varieties that is not covered in this report. No attempt is even made to estimate yields and production. 1/ Nor are the effects and implications of these varieties discussed. Rather it was decided to focus the limited resources available on collecting and reporting the basic statistics. Judging from the wide use of the data presented in previous reports, this has been a useful course of action.

Those with a more general interest in the high-yielding varieties are referred to the references noted below. 2/ Others will be cited in the course of this report.

1/ Comprehensive yield and production estimates for wheat, based on area data presented in earlier versions of this report, are provided by Sheldon K. Tsu in High-Yielding Varieties of Wheat in Developing Nations, U.S. Department of Agriculture, Economic Research Service, ERS-Foreign 322, September 1971, 40 pp.

2/ Clifton R. Wharton Jr.,"The Green Revolution: Cornucopia or Pandora's Box?" Foreign Affairs, April 1969, pp. 472-473; Jospeh W. Willett, The Impact of New Grain Varieties in Asia, U.S. Department of Agriculture, Economic Research Service, ERS-Foreign 275, July 1969, 26 pp.; Lester R. Brown, Seeds of Change, Praeger, 1970, 205 pp.; Walter P. Falcon, "The Green Revolution: Generations of Problems," American Journal of Agricultural Economics, December 1970, pp. 698-710; F. F. Hill and Lowell S. Hardin, "Crop Production Successes and Emerging Problems in Developing Countries," in Some Issues Emerging from Recent Breakthroughs in Food Production (ed. by K. L. Turk), New York State College of Agriculture, Cornell University, 1971, pp. 3-29; and Francine R. Frankel, India's Green Revolution: Economic Gains and Political Costs, Princeton University Press, 1971, 232 pp.

A. Definitions

There is no one commonly accepted definition of high-yielding varieties of wheat and rice. In this bulletin we will primarily be concerned with: (1) dwarf and semi-dwarf fertilizer-responsive varieties developed at the International Wheat and Maize Improvement Center (CIMMYT) in Mexico and the International Rice Research Institute (IRRI) in the Philippines; and (2) direct descendants of these varieties developed in national breeding programs.

This definition is not without its limitations. First, it does not include all high-yielding varieties. Secondly, the varieties reported are not high-yielding under all conditions. Thirdly, the area of such varieties is not always reported separately. Fourthly, it is difficult to keep the Mexican or IRRI lineage straight. Finally, these varieties have been inadvertently mixed with local varieties in some nations and may have lost part of their high output potential.

The result is that the data reported here may not fit everyone's definition of high-yielding varieties. 3/ Some do not even fit the above definition. The most important known exception is the rice information for India: the government data include, without breakdown, the area planted to two other major types of improved rice (ADT-27 and Taichung Native 1). 4/ Some sister varieties are included in the Malaysian figures. Similarly, the Philippine data include two improved series of rice recently developed by government agencies (the BPI series and the C series). 5/ Where the exact varietal composition is known, it is presented in the footnotes.

On the other hand, some improved varieties which might be considered high-yielding, but which have been in use for some time, are excluded.

3/ In a recent FAO report, many of the locally developed varieties were placed in an "intermediate yielding" category. This approach has promise, but suffers from some of the same limitations: (1) the yields from the local varieties may not be markedly different; (2) as the international stock is used for local breeding, it is difficult to tell when it moves from one category to another; and (3) the production data may not be reported separately.

4/ ADT-27 was the best known product of a joint program conducted by the Indian Council of Agricultural Research and the Food and Agriculture Organization (for background, see Gove Hambidge, The Story of FAO, Van Nostrand, 1955, pp. 145-148). Taichung (Native) 1 came from Taiwan.

5/ The BPI series (which includes BPI-76) was developed by the Bureau of Plant Industry of the Philippine Government, the C series (C4-63, C4-113) was developed by the College of Agriculture of the University of the Philippines. There is some question whether the yields of BPI-76 justify its inclusion as a high-yielding variety.

Major examples are (1) wheat in Mexico itself and early varieties in some other Latin American nations, 6/ and (2) certain rice varieties in Taiwan (the ponlai series) 7/ and Ceylon (the H series). 8/

B. The Data

The data on imports and area generally come from different sources. Most are unpublished. They apply to July-to-June crop years.

The seed figures are believed to be relatively accurate, but quite incomplete (except for unusually large shipments). 9/ Virtually all of the statistics on Philippine exports of rice were provided by Dr. Randolph Barker of IRRI. 10/ In a few cases, the import figure represents an authorization rather than an actual shipment; such figures are placed in parentheses. 11/

The area information is largely based on reports submitted by AID country missions or U.S. agricultural attaches. These data, in turn, were usually obtained from official reports or estimates by the countries themselves. There is no way of knowing how accurate the figures are, and, therefore, they should be regarded as only approximate. While most of the figures refer to plantings, harvested area is reported in a few cases.

6/ The proportion of wheat area planted to improved varieties in Mexico went over 90% in 1957; the improved wheat area from 1960 to 1965 averaged from 1.8 to 1.9 million acres (Dana G. Dalrymple, New Cereal Varieties: Wheat and Corn in Mexico, Spring Review, AID, July 1969, 32 pp.). Total Mexican wheat area has averaged as follows in recent years: 1965-69, 1,856,000 acres; 1970, 1,767,000; and 1971, 1,606,000. Background on the early work in Mexico and other Latin American nations is provided by E. C. Stakman, et al., in Campaigns Against Hunger, Belknap Press, Cambridge, 1967, pp. 216-272.

7/ The Japanese initiated rice breeding work in Taiwan early in the century.

8/ The leading local variety is H-4, which was developed in the early 1950's.

9/ The data, however, may not always be assigned to the correct crop year. Where possible, the date of shipment is reported.

10/ In the case of rice, only shipments of 0.1 metric ton or more are included. Where the seed was purchased directly from IRRI, this is so indicated in the footnotes; otherwise, seed was purchased from commercial sources in the Philippines.

11/ This applies where a nation has requested seed from India or Pakistan. Data on exports by these countries are less complete for the 1970's than they were in the 1960's.

For each import and area figure, a footnote is usually provided and a reference is always included. The footnote usually includes information on varietal breakdown, seasonal distribution, or geographical spread.

In addition to the countries reported as importing or planting new varieties, many others have them under test. And some of these nations, though not recorded here, may have moved into commercial production. 12/

C. Seasonal Distribution

Both the Mexican-type wheats and IRRI-type rices have some flexibility with respect to planting date in the developing nations. That is, they may be grown in the dry winter season and wet summer season. There are, however, some differences between the two crops.

Wheat. Wheat is normally considered to be of two types, winter and spring. Botanically the Mexican varieties are spring wheats; such wheats are planted in the spring and harvested in late summer. Where winters are mild, however, spring wheats may, like winter wheats, be planted in the fall and harvested in the spring. This practice is enhanced by the photoperiod insensitive nature of the Mexican wheats. The winter culture of spring wheats is generally utilized in the less developed nations in warm regions. 13/ In some regions where there is a heavy summer monsoon, culture of Mexican varieties may be largely limited to the winter season.

Rice. The wet summer season is the traditional period for rice culture. Where irrigation or sufficient rainfall are available in tropical areas, rice may also be grown during the winter months. 14/ In fact, there is evidence that in many areas the IRRI-type rices are more responsive to nitrogen fertilizers and produce higher yields during the winter months when high solar radiation prevails. 15/ Their photoperiod insensitivity may shorten the growing period and facilitate multiple cropping.

12/ This is a particular possibility in Thailand. Unofficial estimates vary, but suggest that 400,000 acres or more of high yielding rice (RD-1, RD-3, C4-63) were planted during the 1970/71 season. Official data are not available.

13/ In Turkey it is possible to plant Mexican varieties during the winter in the southern coastal areas, but it is necessary to use winter wheat varieties in the cold and dry Anatolian Plateau.

14/ During the 1968/69 crop year, about 30% of the high-yielding rice in India was planted during the dry (rabi) season; similarly, 75% of the IRRI rice in East Pakistan during the 1970/71 crop year was planted during the winter (boro) season.

15/ T. T. Chang, "The Genetic Basis of Wide Adaptability and Yielding Ability of Rice Varieties in the Tropics," International Rice Commission Newsletter, 1967 (Vol. 16, No. 4), pp. 4-12.

II. ORIGIN AND DEVELOPMENT OF HIGH-YIELDING VARIETIES 1/

The origin and development of the varieties reported in this bulletin is considerably more involved than their classification as Mexican wheats and IRRI rice varieties might suggest.

A. Wheat

The Mexican wheat varieties discussed here are descendants of both Japanese and American varieties and breeding efforts.

Japan has had a long history in the development of dwarf wheat. In 1873, Horace Capron, former U.S. Commissioner of Agriculture who headed a mission to Japan, wrote that "the Japanese farmers have brought the art of dwarfing to perfection." He noted that "the wheat stalk seldom grows higher than 2 feet, and often not more than 20 inches." The head was short but heavy. The Japanese claimed that the straw had been so shortened "that no matter how much manure is used it will not grow longer, but rather the length of the wheat-head is increased." Capron noted that "on the richest soils and with the heaviest yields, the wheat-stalks never fall down and lodge." 2/

The Japanese crossed one such variety, Daruma, with a strain of the American soft red winter variety, Fultz, in 1917. The cross eventually produced a strain known as Fultz-Daruma. This strain was in turn crossed with the American hard red winter variety Turkey Red in 1924 and led to a number of different types. One of these was later known as Norin 10; it was registered and released to Japanese farmers in 1935. 3/

In 1946, Dr. S. C. Salmon, a U.S. Department of Agriculture scientist who was the agricultural advisor to the occupation army in Japan, noted Norin 10 growing at a research station. The stems were short, but the heads

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1/ The reader may also wish to consult D. S. Athwal, "Semidwarf Rice and Wheat and Global Food Needs," The Quarterly Review of Biology, March 1971, pp. 1-34.

2/ Horace Capron, "Agriculture in Japan," Report of the Commissioner of Agriculture for the Year 1873, Washington, 1874, p. 369.

3/ L. P. Reitz and S. C. Salmon, "Origin, History, and the Use of Norin 10 Wheat," Crop Science, November-December 1969 (Vol. 8, No. 6), pp. 686-689. It is not known exactly how Fultz and Turkey Red got to Japan, but Fultz arrived before 1892. Fultz was first selected in Pennsylvania in 1862 and could have been introduced by the Capron Mission during the early 1870's. Turkey Red, better known as Turkey, was introduced in Kansas in 1873 by a group of Russian Mennonites; it later became the leading U. S. variety. For details on Fultz and Turkey, see J. A. Clark et al., Classification of American Wheat Varieties, U. S. Department of Agriculture, Bulletin No. 1074, November 1922, pp. 83-85, 144-147.

were-full sized. Dr. Salmon brought seed back to the United States. 4/

Although Norin 10 was not satisfactory for direct use outside of Japan, it was useful for cross breeding. Dr. O. A. Vogel of the U.S. Department of Agriculture first used it in his cooperative breeding programs at Washington State University. Dr. Norman Borlaug of the Rockefeller Foundation obtained some of the early crosses in 1953 for his breeding work in Mexico (subsequently carried out at the International Maize and Wheat Improvement Center - CIMMYT). These lines were crossed with Mexican, Colombian, and other wheats, and a series of spring wheat varieties were produced, including Lerma Rojo, Mayo 64, Penjamo 62, Sonora 63, and Sonora 64. 5/

While no attempt is made here to trace out all the "Mexican" varieties presently in use in other nations, 6/ India provides an interesting example of the changes that have taken place. In 1963, Dr. Borlaug sent 100 kg. (220 lbs.) of several Mexican varieties to India; included were Mayo 64, Sonora 63, Sonora 64, Lerma Rojo 64, and line 8156. In the summers of 1965 and 1966, large quantities of Sonora 64 and Lerma Rojo seed -- both with a red grain -- were imported from Mexico and were widely planted. Meanwhile, breeding work continued in India using line 8156; in 1967 three amber grained strains were released: Kalyan Sona, 7/ Sonalika, and Chotti Lerma (S.331). Also, amber strains of Sonora 64 and Lerma Rojo 64 have been developed; they are known respectively as Sharbati Sonora and Safed Lerma. 8/ By November 1969, the Indian Planning Commission was able to report that "the pure Mexican varieties introduced earlier had been practically replaced."9/ And in the most recent CIMMYT report, it is stated that India is entering the

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4/ Reitz and Salmon, op. cit., p. 687.

5/ L. P. Reitz, "Short Wheats Stand Tall," 1968 Yearbook of Agriculture, U. S. Department of Agriculture, pp. 236-237. Also see L. P. Reitz, "New Wheats and Social Progress," Science, September 4, 1970, pp. 952-955; and Don Paarlberg, Norman Borlaug - Hunger Fighter, U. S. Department of Agriculture, PA 969, December 1970, 20 pp.

6/ For genetic detail, see Results of the Fifth International Spring Wheat Yield Nursery, 1968-1969, CIMMYT, Research Bulletin No. 19, March 1971, pp. 4-8.

7/ Sister varieties of Kalyan Sona include Siete Cerros and Super X (red) in Mexico, Mexipak in Pakistan, and Espigas in Turkey.

8/ Developed from information provided in: Carroll P. Streeter, A Partnership to Improve Food Production in India, The Rockefeller Foundation, 1969 or 1970, pp. 12-17; letter from James H. Boulware, Agricultural Attache, American Embassy, New Delhi, June 12, 1970.

9/ Evaluation study of High Yielding Varieties Programme, Report for the Rabi 1968-69 - Wheat, Paddy and Jowar, Government of India, Planning Commission, Program Evaluation Organization, p. ii. Kalyan Sona accounted for about one-fourth of production (p. 49).

third and fourth cycle of dwarf wheat development. The third cycle represents Indian varieties such as Lal Bahadur, U.P. 301, and Kiran developed from introduced materials and subsequently selected entirely under Indian conditions. The fourth cycle represents varieties that are being developed from crosses made in India, most frequently involving Indian and CIMMYT-Mexican parents. 10/

B. Rice 11/

There are two major groups of rice varieties: indica and japonica. 12/

- Indica is the major group grown throughout South and Southeast Asia and in most areas of China. The majority of indica varieties raised in the monsoon tropics have evolved from combined natural and human selection processes. They are well adapted to conditions of low soil fertility, uncertain weather, and poor water control. Most indicas have resistance to endemic diseases and insects, and compete well with weeds. They also have the dry cooking characteristics preferred by consumers in tropical and sub-tropical areas. But the features that enable the tropical types of indicas to survive -- tall and high tillering plants, late maturity, long drooping leaves, etc. -- also provide the basis for their weakness under modern agricultural practices. Improved fertilization, for instance, will lead mainly to vegetative growth and lodging rather than a significantly increased yield.

- Japonica varieties are widely distributed in different areas of the temperate zone. The varieties evolved more recently than the indicas and are the result of an intensive human selection process. In comparison with the indicas, they have darker and more upright leaves, a shorter and stiffer stalk, earlier maturity, and a more thrifty vegetative growth. Japonicas respond well to improved cultural practices -- especially fertilizer -- and are more resistant to lodging. As a result, yields are considerably higher than for the indicas. Japonicas are not, however, well adapted for the traditional cultural practices in tropical Asia; among other things, (1) the varieties require precise control of water, weeds, and insect pests; (2) most are susceptible to the virus diseases of the tropics; (3) some react to the high temperature during early growth stage by flowering too early; (4) they lack the grain dormancy needed in the monsoon season and (5) the grains have a sticky cooking quality not desired by consumers.

10/ CIMMYT, 1969-70 Report, International Maize and Wheat Improvement Center, 1971, pp. 85-96.

11/ Dr. T. T. Chang, of the International Rice Research Institute, was of great help in the preparation of this section.

12/ See Takane Matsuo, Rice and Rice Cultivation in Japan, Institute of Asian Economic Affairs, Tokyo, 1961, pp. 9-25.

Attempts have been made over the course of many years to improve both types of rice for use in the tropics.

- Japonica. Research work on this group was initiated in Japan nearly 70 years ago. Successes were obtained in breeding more nitrogen-responsive and disease-resistant types. 13/ A breeding program to develop daylength and temperature-insensitive types was initiated in Taiwan in the early 1920's and resulted in "ponlai" varieties (such as Taichung 65). 14/ These varieties made double cropping of rice possible using a single variety for both crops. 15/ Between 1925 and 1940, 50% of the rice land in Taiwan was shifted to the ponlai varieties. 16/ Subsequent research verified their high-yielding ability over a wide area in tropical Asia and Africa. 17/ But the ponlais did not gain wide commercial acceptance because of disease problems and grain features.

- Japonica x India Crosses. The FAO-India program noted earlier in this bulletin (p. 2, fn. 4) was an attempt to cross japonica and indica varieties. Results were generally not satisfactory because nearly all of the japonica parents were from Japan and were poorly adapted to a tropical climate. But one hybrid, ADT-27, did show a substantial improvement over local varieties and subsequently was widely planted in the Tanjore district. This breeding program also produced a few other varieties. One, Mahsuri (Taichung 65 x Mayang Ebos 80), was further developed in Malaysia with Japanese assistance and is now extensively planted. 18/ Recently, a cooperative project between Korean scientists and the International Rice Research Institute has led to the introduction of Tongil (known temporarily as IR-667-98), a cross between IR-8 and (Yukara x TN-1); it is estimated that about 7,200 acres were grown

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13/ Ibid., pp. 20-27, 91-93.

14/ Several of the ponlai varieties included an indica in their parentage. Details on the development of ponlai varieties are provided in E. Iso, Rice and Crops in Its Rotation in Subtropical Zones, Japan FAO Association, Tokyo, 1954, pp. 106-137.

15/ C. H. Huang, W. L. Chang, and T. T. Chang, "Ponlai Varieties and Taichung Native 1," paper presented at the Symposium on Rice Breeding, IRRI, September 1971, 30 pp.

16/ S. C. Hsieh and V. W. Ruttan, "...Factors in the Growth of Rice Production...," Food Research Institute Studies, 1967 (No. 3), p. 331.

17/ T. T. Chang, "The Genetic Basis of Wide Adaptability and Yielding Ability of Rice Varieties in the Tropics," International Rice Commission Newsletter, December 1967, pp. 4-15.

18/ Malinja, another variety developed in the same program and planted in Malaysia, represents a cross between two indicas, Siam 29 and Pebifun. Pebifun originally came from Taiwan where it was once a leading variety. (Letter from Chang, October 27, 1970.)

during the summer of 1971, 95% for seed purposes. 19/

- Indica. Attempts to improve indica varieties in the 1950's were moderately successful. Results of this work include H-4 and H-5 in Ceylon, and Peta, Sigadis, Bengawan, and Remadja in Indonesia.

Taichung Native 1 (TN-1) was developed in Taiwan after World War II by crossing Dee-geo-woo-gen, a short variety which is thought to have come from Fukien Province in southern China several hundred years before 20/, with a tall drought-resistant local variety. It was the first indica to respond as or better to fertilization than the ponlais. 21/ TN-1 had its major impact on rice production in India. Jaya, a new Indian variety, represents a cross of TN-1 and T. 141, a tall Indian variety from Orissa. Padma, another recent Indian variety, came from the same cross, but matures earlier than TN-1. 22/ More recent releases in India are Hamsa, Krishma, Cauvery, Bala, Ratna, Vijaya, CO-34, Jamuna, Sabarmati, Pankaj, and Jagannath. 23/

Breeding programs in the Philippines have produced BPI-76 and C4-63 (Peta x BPI-76), both of which are widely planted. A number of semi-dwarf hybrids have been developed in Thailand, including the RD series. 24/

19/ Letter from M. H. Heu, Department of Agronomy, College of Agriculture, Suwon, November 27, 1971; "IR667-98, A Cool Climate semidwarf," The IRRI Reporter, No. 1, pp. 1-2.

20/ Noted in T. S. Miu (ed.), A Photographic Monograph of Rice Varieties of Taiwan, Taiwan Agricultural Research Institute, Special Publication No. 2, December 30, 1959, p. 67. (Reference provided by C. Roy Adair of the Agricultural Research Service, USDA.)

21/ See T. T. Chang, Recent Advances in Rice Breeding In Taiwan, Joint Commission on Rural Reconstruction, Plant Industry Series 22, 1961, pp. 33-58.

22/ S. V. S. Shastry, "New High-Yielding Varieties of Rice: Jaya and Padma," Indian Farming, February 1969, pp. 5-13; Streeter, op. cit., pp. 26, 28.

23/ Morphological and Physiological Characteristics of Some High-Yielding Rice Varieties, IADP Technical Bulletin 9, 1970, 41 pp. (Eluru, India); letter from Chang, September 24, 1971. Pankaj and Jagannath are similar in height to IR-5.

24/ The RD series was first introduced in 1969. RD-1 and RD-3 are non-glutinous varieties. RD-2, whose genetic origin is noted on p. 10, is a glutinous variety which is grown in the northeast (letters from William R. Burton, Dept. of Agricultural Economics, Kasetsart University, Bangkok, November 27, December 18, 1971). Also see the articles by B.R. Jackson et al., and A.C. Yantasast et al. on dwarf varieties in the Thai Journal of Agricultural Science: 1969, pp. 83-92; 1970, pp. 119-133.

The IR series was, of course, developed at the International Rice Research Institute in the Philippines. IR-8 was obtained by crossing Peta with Dee-geo-woo-gen. The first cross was made in 1962 and the variety was released in November 1966. 25/ IR-5 was developed concurrently from a cross between Peta and Tangkai Rotan, a Malaysian variety (hence IR-5 does not have the same Chinese semi-dwarf gene as IR-8 but is of moderately short height); it was announced in December 1967. 26/ IR-20 was selected between IR262-24-3 (a descendant of a cross between Peta and TN-1) and TKM-6, an Indian variety. IR-22 was selected from a cross, also made in 1965, between IR-8 and Tadukan, a Philippine variety. Both IR-20 and IR-22 were named in December 1969. 27/ IR-24 was developed from a cross of IR-8 and /(CP230 x SLO-17) x Sigadis/ and named in May 1971; it has slender grains similar to those of IR-22, but the cooked rice is soft and moist. 28/ Selections from the IRRI breeding program in the Philippines which have been named as varieties in other countries include: Mehran 69 (Siam 29 x Dee-geo-woo-gen) in West Pakistan; RD-2 (Gam Pai 15/2 x TN-1) in Thailand; Sinaloa A68 (Nahng Mon S-4 x TN-1) in Mexico; and CS-2 (Nahng Mon S-4 x TN-1) in Ivory Coast. 29/ Another selection, CICA 4 (IR 12-178-2-3 x IR-8), was recently named in Colombia. 30/

25/ For details, see Robert F. Chandler, "Dwarf Rice - A Giant in Tropical Asia," 1968 Yearbook of Agriculture, pp. 252-255; Streeter, op. cit., pp. 26-29.

26/ Further information on IR-5, including a specific comparison with IR-8, is provided in "IR-5 - A New High-Yielding IRRI Variety," The IRRI Reporter, January 1968, 4 pp. Selections from the IR-5 line are known as Pankaj in India (IR-5-114-3) and Bahagia in Malaysia (IR5-278).

27/ Additional information, including a detailed comparison with IR-8 and IR-5, is found in "IR-20 and IR-22, New Rice Varieties," The IRRI Reporter, January 1970, 4 pp. East Pakistan selections from the same cross as IR-20 are known as Chandina (IR532-1-176) and Irrisail (IR5 32-E-576 or IR-20).

28/ Further details on IR-24 are presented in The IRRI Reporter, No. 2, 1971, pp. 1-2.

29/ IRRI Annual Report for 1970, 1971, p. 211; H. M. Beachell, G. S. Khush, and R. C. Aquino, "IRRI's International Breeding Program," paper presented at the Symposium on Rice Breeding, IRRI, September 1971, 29 pp.

30/ It was released by the Centro Internacional de Agricultura Tropical (CIAT) and the Instituto Colombiano Agropecuario (ICA). ("Two New Rice Varieties for Latin America," Noti-Ciat, May-June, 1971). IR-22 was released at the same time.

III. HIGH-YIELDING VARIETIES OF WHEAT

The data for wheat are divided into two parts. In the first section, which accounts for the majority of the chapter, imports and plantings are reported individually for 13 countries. In the second part, seed imports are reported for six countries where we do not yet have information on area planted.

A. Imports and Plantings

Data on imports and commercial plantings of dwarf and semi-dwarf high-yielding wheat varieties of Mexican descent are, at this point, limited to Asia and North Africa. Hopefully more data will become available on Latin America in the future. 1/

Among the countries not currently included, two -- Mexico and Egypt -- are known to have significant areas of improved wheat. As noted earlier (p. 3, fn. 6), the proportion of wheat area planted to improved varieties in Mexico went over 90% in 1957, but this was not originally of the semi-dwarf type. 2/ Similarly, about 90% of the wheat area in Egypt is planted to an improved local variety (Giza 155). 3/

Some of the wheat data reported here do not agree with those reported by CIMMYT in their annual reports or, more recently, by an FAO cereal

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1/ Cooperative research efforts between CIMMYT and national scientists in Argentina, Chile, and Brazil are briefly described in the CIMMYT 1969-70 Report, pp. 112-113. One source indicates that in Guatemala, 7,400 acres of Mexican varieties, or local varieties developed from Mexican stock, were planted during the 1969/70 crop year.

2/ Semi-dwarf varieties were not introduced in Mexico until 1961 and did not begin to have an impact on production until 1963 (Norman Borlaug, "Wheat Breeding and its Impact on World Food Supply," Proceedings of the Third International Wheat Genetics Symposium, Canberra, 1968, p. 7). They and dwarf varieties now account for essentially all of the improved wheat area.

3/ The total wheat area in Egypt was about 1.35 million acres in 1971. Giza 155 was released in 1968/69. Subsequent comparisons with Mexican varieties (Mexipak and Super X) showed about equal yields. The Deputy Prime Minister for Agriculture noted in August 1971 that:

> We recently succeeded in developing a new strain of wheat which combines the characteristics of Mexican wheat with the local one /Giza 155/. It proved superior to both..., with a 15% greater yield per faddan. We are now subjecting the new strain to yield tests...

(Fathi Salim, "Local Egyptian Wheat Found Superior to Newly Developed Mexican Strain," Akhbar al-Yawm, Cairo, August 21, 1971, p. 3; translation in JPRS 54156, September 29, 1971; also see Hafiz, next footnote.)

specialist at a CIMMYT conference. 4/ In some cases the differences are not great and may be due to the revision of data or to rounding. But in other instances the differences are larger and may be due to the fact that the estimates were obtained from different sources. The data reported here differ significantly from those presented by the FAO specialist in the following cases: Afghanistan, India, Lebanon (1970/71), Nepal, and Turkey (1968/69). Given the nature of this kind of data, however, it is surprising that the estimates agree as much as they do.

4/ Abdul Hafiz, "Present Status of Wheat Research and Production Programmes in the Near East Region," FAO, Cairo, September 1971, Table III. Hafiz is Regional Consultant, Near East Cereal Improvement and Production Project.

AFGHANISTAN

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1965/66	50 1/ (1)	-
1966/67	420 2/ (2)(3)	4,500 4/ (5)
1967/68		54,400 (6)
1968/69		301,500 (6)
1969/70		360,800 (7)
1970/71		574,300 (4)
1971/72	6,000 3/ (4)	

Notes

1/ Lerma Rojo 64A. Imported from Mexico in 1965.

2/ Lerma Rojo 64: 250 tons from Mexico (ref. 2), and 170 tons from Pakistan (ref. 3).

3/ Mexipak from Pakistan; 2,000 tons certified, 4,000 tons uncertified. As of December 1971, the certified seed had been received and planted; the uncertified seed was expected to be received in time for spring planting. These imports were stimulated by a prolonged drought.

4/ Of this total, nearly 2,000 acres were Lerma Rojo 64A and 1,900 Tascosa.

References

(1) "The Green Revolution," Participant Report, US/AID, Kabul, Summer 1969, p. 2.

(2) Fourth Annual Wheat Seminar, August 28, 1969 - September 8, 1969, Ministry of Agriculture and Irrigation, Kabul; summary paper by Joe Motheral.

(3) CIMMYT Report, 1967-68, International Maize and Wheat Improvement Center (CIMMYT), Mexico City, pp. 59, 72.

(4) Letters from John R. Wilson, Food and Agriculture Officer, US/AID, Kabul, November 27, 1971, December 22, 1971.

(5) Agricultural Development in Afghanistan, with Special Emphasis on Wheat, U.S. Agricultural Review Team, July 1967, pp. 31-32.

(6) Department of State Airgram TOAID A-574 from Kabul, December 8, 1969, p. 8 (Table II).

(7) Letter from Joe R. Motheral, Food and Agriculture Officer, US/AID, Kabul, September 23, 1970.

ALGERIA

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1969/70	1,500 1/ (1)	12,400 3/ (3)
1970/71	(10) 2/ (2)	346,000 3/ (3)

Notes

1/ Imported from Mexico. Substantial quantities of seed were also imported from Morocco and Tunisia.

2/ Authorization for West Pakistan to export 10 tons of Mexipak seed to Algeria (to leave July 1970).

3/ Estimated.

References

(1) Conversation with Dr. Gregorio Martinez V. of CIMMYT, December 17, 1970.

(2) Department of State Telegram 117861 to Rawalpindi, July 22, 1970.

(3) Letter from Dudley G. Williams, Agricultural Attache, American Embassy, Rabat, Morocco, October 12, 1971.

INDIA*

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1965/66	250 1/ (1) (2)	7,400 (3)
1966/67	18,000 2/ (1) (2)	1,270,000 3/ (4)
1967/68		7,270,000 3/ (4)
1968/69		11,844,000 3/ (4)
1969/70		12,133,000 3/4/(5)
1970/71		14,559,000 3/ (5)

Notes

* See Chapter II (wheat), pp. 6-7, for a discussion of the evolution of Mexican varieties in India.

1/ 200 tons of Sonora 64 and 50 tons of Lerma Rojo 64.

2/ Mostly Lerma Rojo 64; remainder Sonora 64.

3/ The distribution of this area by State was:

	Uttar Pradesh	Punjab	Other
1966/67	71%	12%	17%
1967/68	54	22	24
1968/69	52	25	23
1969/70	33	29	38
1970/71	32	37	31

4/ This is considerably less than the preliminary figure of 15.1 million cited in last year's report.

References

(1) Rice and Wheat in India, Spring Review (AID), March 10, 1969, p. 7.

(2) Five Years of Research on Dwarf Wheat, Indian Agricultural Research Institute, New Delhi, 1968, Preface; Grant Cannon, "On the Eve of Abundance," Farm Quarterly, Fall Forecast, 1967, pp. 89-90.

(3) 1966/67 CIMMYT Report, p. 67.

(4) "Report on Price Policy for Kharif Cereals for the 1970-71 Season," Agricultural Prices Commission, New Delhi, August 1970, p. 27.

(5) "Report on Price Policy for Kharif Cereals for the 1971-72 Season" Agricultural Prices Commission, New Delhi, September 1971, Table 4.

IRAN

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1968/69	1,500 1/ (1)	25,000 3/ (3)
1969/70	4,000 2/ (2)	222,400 4/ (4)
1970/71		321,200 5/ (5)

Notes

1/ Penjamo 62 imported from Turkey.

2/ About 2,500 tons of Bezostaya No. 1 from USSR and 1,500 tons of Mexican Inya 66 from Denmark. Of the Bezostaya seed, 500 tons were planted during the 1969/70 season and 2000 tons during the 1970/71 season (ref. 6).

3/ "About 10,000 hectares;" Penjamo 62.

4/ Mexican type wheat.

5/ About 27,000 acres of Bezostaya could have been planted considering the seed available (ref. 6). The government recently announced plans to "encourage use of additional Mexican dwarf wheat seeds" during the 1971/72 crop year (ref. 7).

References

(1) Foreign Agricultural Service Reports from Tehran: IR-9003, January 20, 1969; IR-9006, February 5, 1969.

(2) Foreign Agricultural Service Report IR-0018 from Tehran, October 8, 1970.

(3) Foreign Agricultural Service Telegram TOFAS 60 from Tehran, October 25, 1969.

(4) Foreign Agricultural Service Telegram TOFAS 83 from Tehran, December 17, 1970.

(5) Cable from Dr. Abdul Hafiz, Regional Consultant, Cereal Improvement and Production Project, FAO, Cairo, December 22, 1971.

(6) Letter from Said Bahreyni, Economic Advisor, Office of Agricultural Attache, American Embassy, Tehran, October 9, 1971.

(7) Foreign Agricultural Service Report IR-1017 from Tehran, November 6, 1971.

Wheat

IRAQ

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1965/66	5 1/ (1)	
1967/68	800 2/ (2)	15,800 1/ (1)
1968/69		103,000 1/ (1)
1969/70		482,400 1/3/(1)
1970/71		309,000 1/ (3)

Notes

1/ Mexipak.

2/ Mexipak shipped from West Pakistan, September 1968.

3/ May be high.

References

(1) Abdul Hafiz, "Report on Cereal Improvement and Production in Iraq," FAO, Cairo, April 1971, p. 7.

(2) Foreign Agricultural Service Aircom from Rawalpindi to Program Compliance Division, Export Marketing Service, November 20, 1969.

(3) Abdul Hafiz, "Present Status of Wheat Research and Production Programmes in the Near East Region," FAO, Cairo, September 1971, Table III.

Wheat

JORDAN

Crop Year	Area Planted or Harvested		
	- acres -		
1968/69	230	1/	(1)
1969/70	250	1/	(2)
1970/71	300	1/	(2)

Notes

1/ "Improved" wheat varieties.

References

(1) Department of State Airgram TOAID A-363 from Amman, November 28, 1969, p. 3.

(2) Letter from William Horbaly, Agricultural Attache, American Embassy, Beirut, December 1, 1971.

LEBANON

Crop Year	Area Planted or Harvested		
	- acres -		
1968/69	690	1/	(1)
1969/70	6,000	1/	(2)
1970/71	8,600		(2)

Notes

1/ Mexipak.

References

(1) Letter from William Horbaly, Agricultural Attache, American Embassy, Beirut, September 17, 1970.

(2) Letter from Horbaly, November 9, 1971.

Wheat

MOROCCO

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1967/68	1	1/ (1)	500	(2)
1968/69	500	2/ (3)(4)	12,100	3/ (3)
1969/70			24,700	4/ (5)
1970/71			49,400	(6)

Notes

1/ Siete Cerros (plus 150 kg. of Super X).

2/ Included 250 tons of Siete Cerros, 100 of Inia 66, 100 of Tobari 66, 25 of Penjamo 62, and 25 of Norteno.

3/ 50% Siete Cerros; rest Inia 66, Tobari 66, and Penjamo 62 (ref. 7).

4/ In addition, about 74,000 acres of an Italian semi-dwarf were planted.

References

(1) Department of State Airgram A-272 from Rabat, December 26, 1967.

(2) CIMMYT Report, 1967-68, p. 73.

(3) Morocco: Wheat, Spring Review (AID), March 13, 1969, pp. 2, 4.

(4) "Moroccan Agriculture Thrives on High-Yield Mexican Wheat," Front Lines (AID), February 15, 1969, p. 3.

(5) Letter from Dudley G. Williams, Agricultural Attache, American Embassy, Rabat, October 9, 1970.

(6) Department of State Telegram 3117 from Rabat, June 25, 1971.

(7) CIMMYT Report, 1968-69, pp. 57, 97.

NEPAL

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1965/66			3,500 6/	(1)
1966/67	38 1/	(1)	16,200 7/	(1)
1967/68	450 2/	(1)	61,300 8/	(1)
1968/69	7 3/	(2)	132,900 9/	(2)
1969/70	300 4/	(2)	186,600 9/	(2)
1970/71	136.5 5/	(2)	242,700 9/	(2)

Notes

1/ Lerma Rojo. Imported from Mexico by India.

2/ Lerma Rojo, from India.

3/ S-331, from India.

4/ S-227, from India.

5/ 136 mt of S-227 from India; 0.52 mt Chenab-70 from Pakistan.

6/ Lerma 52.

7/ 14,800 acres of Lerma 52; 1,400 of Lerma Rojo.

8/ 31,600 acres of Lerma 52; 29,700 of Lerma Rojo.

9/ All improved wheat planted.

References

(1) Department of State Airgram TOAID A-404 from Kathmandu, February 16, 1968.

(2) Letter from Raymond E. Fort, Food and Agriculture Division, US/AID, Kathmandu, October 13, 1971 (data from Economic and Planning Division, Ministry of Food and Agriculture).

PAKISTAN

Wheat

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
East				
1968/69			20,000	(1)
1969/70			22,000	(2)
1970/71			24,000	(2)
West				
1965/66	350	1/ (1)(2)	12,000	(1)
1966/67	50	2/ (1)(2)	250,000	(1)
1967/68	42,000	3/ (1)(2)	2,365,000	(3)
1968/69			5,900,000	(4)
1969/70			6,626,000	4/ (5)
1970/71			7,288,000	5/ (5)

Notes

West

1/ 250 tons of Penjamo 62 and 100 tons of Lerma Rojo 64.

2/ Mostly Mexipak 65 (white) (Siete Cerros); some Mexipak Red (Indus 66). In addition, 20 tons were available locally.

3/ 40,000 tons of Mexipak Red (Indus 66) and 2,000 tons of Mexipak 65 (Siete Cerros).

4/ Of the total area, about 81% was Mexipak, 12.5% Indus 66, 4% Norteno 67, and 1% Inia 66 (ref. 6).

5/ Estimate by Office of U.S. Agricultural Attache, Islamabad.

References

East

(1) Foreign Agricultural Service Telegram TOFAS 96 from Rawalpindi, October 15, 1969.

(2) Foreign Agricultural Service Telegram TOFAS 02 from Islambad, January 5, 1972.

West

(1) Rice and Wheat in Pakistan, Spring Review (AID), March 17, 1969, pp. 3-5.

(2) 1966-67 CIMMYT Report, pp. 64-65; Cannon, op. cit., p. 90.

(3) "Country Field Submission: Pakistan, FY 1971," AID, August 1969, Appendix A, Table 1.

(4) Foreign Agricultural Service Report No. PK0003 from Rawalpindi, January 20, 1970, p. 4.

(5) Foreign Agricultural Service Telegram TOFAS 02 from Islamabad, January 5, 1972.

(6) 1969-70 CIMMYT Report, p. 90.

Wheat

SYRIA

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1970/71	5,160 1/ (1)	94,000 2/ (2)

Notes

1/ The varietal composition was as follows: Siete Cerros, 1,870; Inia, 1,150; Pitic 62, 770; Lerma Rojo, 740; Mexipak 65, 540; Penjamo 62, 90. Origin not indicated.

2/ Of the total area, 61,800 acres were under irrigation and 32,100 were rainfed.

References

(1) Abdul Hafiz, "Report on Cereal Improvement and Production in Syria," FAO, Cairo, July 1971, p. 6.

(2) Abdul Hafiz, "Present Status of Wheat Research and Production Programmes in the Near East Region," FAO, Cairo, September 1971, Table III.

TUNISIA

Crop Year	Quantity of Seed Imported		Area Planted or Harvested		
	- metric tons -		- acres -		
1967/68	50	(1)	2,000	1/	(2)
1968/69			32,000	2/	(2)
1969/70			131,000		(3)
1970/71			252,000		(4)

Notes

1/ "Nearly 2,000 acres,"

2/ 35% Inia 66, 35% Tobari 66, 15% Jaral, and 15% Sonora 63 (ref. 3).

References

(1) "Tunisia to Close 'Wheat Gap,'" Front Lines (AID), December 15, 1968, p. 7.

(2) Foreign Agricultural Service Report TN-9004 from Rabat, June 26, 1969.

(3) Letter from Dudley G. Williams, Agricultural Attache, American Embassy, Rabat, Morocco, October 9, 1970.

(4) Letter from Williams, October 12, 1971.

(5) CIMMYT Report, 1968-69, p. 90.

Wheat

TURKEY

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1966/67	60 1/ (1)	1,500 (1)
1967/68	22,100 2/ (2)	420,000 (2)
1968/69		1,444,000 3/ (3)
1969/70		1,343,000 4/5/ (3)(4)
1970/71		1,184,000 4/6/7/ (3)(4)

Notes

1/ Sonora 64.

2/ Only 17,000 tons planted in fall; remainder planted in spring 1968. Included: 6,190 tons of Lerma Rojo 64; 6,950 of Penjamo 62; and 5,860 of Super X.

3/ In addition, about 18,000 acres were planted to Bezostaya, a high-yielding Russian winter wheat, 100 tons of which were first imported in the fall of 1967 (ref. 5).

4/ Covers 20 provinces in Mexican wheat program.

5/ In addition, about 171,000 acres were planted to HYV's in the winter wheat region (161,500 Bezostaya and 9,500 Wasner; Wasner is an improved American variety imported in 1967) (ref. 5).

6/ Altogether, 1,258,000 acres of HYV's were reported planted in the spring wheat area (ref. 6). The HYV's were composed of both Mexican and Italian types. Estimates of the Mexican area range from 1,184,000 to 1,210,800 acres (above and ref. 7); the lower figure seems to have been more commonly used and is cited here. This means that the area composed of Italian varieties was in the 47,000 to 74,000 acre range. The varietal composition of the Mexican varieties was as follows: Penjamo 89%, Lerma Rojo 9%, Super X 1%, Pitic 1% (ref. 5).

7/ In addition, 710,800 acres were reported planted to HYV's in the winter wheat region (619,000 Bezostaya and 91,800 Wasner) (ref. 8). Further areas are planted to improved local varieties.

References

(1) 1966-67 CIMMYT Report, p. 69; CIMMYT Report, 1967-68, p. 59; Joseph R. Williams, "Wheat Program Leads Off Turkey's New 5-Year Plan," Foreign Agriculture, November 20, 1967, p. 5.

(2) Wheat in Turkey, Spring Review (Airgram TOAID A-141 from Ankara, March 21, 1969), pp. 5-6, 12-13. (Also see L. M. Humphrey, Mexican Wheat Comes to Turkey, US/AID, Ankara, April 1969.)

(3) Harvey P. Johnson, High-Yielding Winter Wheat for Turkey - A Progress Report, US/AID, Ankara, August 1971, pp. 1, 8.

(4) Abdul Hafiz, "Present Status of Wheat Research and Production Programmes in the Near East Region," FAO, Cairo, September 1971, Table III.

(5) Letter and enclosure from Keith M. Byergo, Deputy Food and Agriculture Officer, US/AID, Ankara, October 12, 1971.

(6) Department of State Airgram TOAID A-489 from Ankara, December 20, 1971, pp. 3, 4.

(7) Letters from William L. Davis, Agricultural Attache, American Embassy, Ankara, September 22, 1971, January 4, 1972.

(8) Abdul Hafiz, "Report on Cereal Improvement and Production in Turkey," FAO, Cairo, July 1971, p. 10.

B. Imports of Seed

IMPORTS OF MEXICAN WHEAT SEED BY COUNTRIES
WHERE NO PLANTED AREA DATA ARE YET AVAILABLE

Country and Crop Year	Metric Tons	Notes	References
Bolivia			
1968/69	50	1/	(1)
Burma			
1968/69	2	2/	(2)
1969/70	302	3/	(2)(3)
Saudi Arabia			
1969/70	2	4/	(2)
Sudan			
1969/70	(1)	5/	(2)
1970/71	(5)	6/	(4)
Tanzania			
1969/70	3	7/	(2)
Zambia			
1969/70	0.2		(2)

Notes

1/ Two varieties, 25 tons each. (Type not stated, but Jaral 66 and Norteno 67 previously tested.)
2/ Shipped from West Pakistan in September 1968.
3/ Of total, 300 tons shipped from West Pakistan in September 1969; 1.5 tons shipped from India during July-September 1969 period (1 ton of Kalyan Sona; 0.5 ton of Sharbati Sonora).
4/ Gift from West Pakistan.
5/ Gift from West Pakistan, shipped September 1969.
6/ Authorization for West Pakistan to export 5 tons of Mexipak.
7/ Gift from West Pakistan; shipped June 1969.

References

(1) Department of State Telegram 5196 from La Paz, June 21, 1968; Airgram A-802 from La Paz, July 3, 1968.
(2) Foreign Agricultural Service Aircomm from Rawalpindi to Program Compliance Division, Export Marketing Service, November 20, 1969.
(3) Foreign Agricultural Service Report No. IN0025 from New Delhi, February 19, 1970.
(4) Department of State Telegram 117861 to Rawalpindi, July 22, 1970.

IV. HIGH-YIELDING VARIETIES OF RICE

This chapter, like the previous one for wheat, is divided into two parts. The first portion reports imports and plantings individually for 10 countries. The second summarizes data on exports of rice seed by the Philippines -- both by the International Rice Research Institute (IRRI), and by government and private interests -- to 15 countries where we do not yet have detailed estimates of planted area. 1/

All of the data on Philippine exports of seed have been provided by Dr. Randolph Barker of IRRI. Some of these statistics were supplied in October 1970. The reference to this data in the country table reads simply "Barker (October 1970)." (As of November 1971, no exports were reported by public and private agencies in the Philippines.) In addition, reference is made to an article by Dr. Barker, "Economic Aspects of High-Yielding Varieties of Rice, With Special Reference to National Price Policies," Monthly Bulletin of Agricultural Economics and Statistics (FAO), June 1969, pp. 1-2; it is noted as "Barker (June 1969)."

A. Imports and Plantings

All the countries included in this section are located in Asia. Similar data have not yet been found for Africa or Latin America. It has been estimated, however, that from 750,000 to 1,000,000 acres (300,000 to 400,000 hectares) of improved varieties, principally IR-8, were planted in Latin America in 1970/71. The approximate proportion of rice area planted to these varieties by country was as follows: Cuba, 90%, Costa Rica, 75%; Mexico and Nicaragua 50%; Colombia, Ecuador, and Peru, 20-25%. In addition, significant areas were planted in Guyana and Venezuela. 2/ Seed imports by several of these countries are noted in section B. Hopefully it will be possible to have more detailed statistics in another year.

In addition to the Asian statistics reported in the following pages, it should be recalled from previous chapters that roughly 400,000 acres of high-yielding rice were planted in Thailand during the 1970/71 season (Chapter I, p. 4, fn. 12) and that about 7,200 acres were planted (95% for seed purposes) in South Korea in the summer of 1971 (Chapter II, pp. 8-9).

1/ Recent details on the IRRI program of work are contained in the Annual Report for 1970 (issued in 1971, 265 pp.). International activities with scientists in Pakistan, India, Ceylon and Indonesia are briefly noted on p. 258.

2/ Pedro A. Sanchez, "Trip Report to Colombia and Peru, October 10-26, 1971," Soil Science Department, North Carolina State University, Raleigh, p. 2. Venezuela recently authorized the import of 50 tons of IR-22 from Colombia (Foreign Agricultural Service Report VZ-1139 from Caracas, December 22, 1971).

BURMA

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1966/67	0.1	1/ (1)	19	6/ (3)
1967/68	200	2/ (1)	8,500	6/ (3)
1968/69	-	3/ (2)	412,400	7/ (3)
1969/70	200	4/ (2)	355,900	8/ (3)
1970/71	100	5/ (2)	496,300	9/ (4)

Notes

1/ IR-8. Imported from IRRI in 1966.

2/ IR-8. Imported from the Philippines in 1967.

3/ IR-8, IR-5. Less than 0.1 ton of each imported from IRRI in 1968.

4/ IR-5. Imported from the Philippines in 1969.

5/ IR-20. Imported from the Philippines in 1970.

6/ IR-8.

7/ IR-8. In addition, 60 acres of Ngwetoe, an improved local variety, were planted.

8/ IR-8 was planted on 321,600 acres, IR-5 on 11,800, and Ngwetoe on 22,500. In August 1970, C4-63 from the Philippines was being test planted on about 100 acres.

9/ The varietal distribution was as follows: IR-5, 427,250 acres; Ngwetoe, 41,980; IR-8, 24,570; and C-4/63, 2,500. In the future, the area of C-4/63 is expected to expand sharply on area formerly planted to IR-5.

References

(1) Barker (June 1969). Also see Gladys Charitz, "Rice Surplus Affirms Success," Journal of Commerce, March 29, 1968.

(2) Barker (October 1970).

(3) Official sources, August 4, 1970.

(4) Official sources, February 13, 1971, November 10, 1971.

Rice

CEYLON

Crop Year	Quantity of Seed Imported			Area Planted or Harvested		
	- metric tons -			- acres -		
1967/68	0.5	1/	(1)			
1968/69	211	2/	(1)	17,240	5/	(3)
1969/70	-	3/	(2)	65,100	6/	(4)(5)
1970/71	0.4	4/	(2)	73,000	7/	(5)(6)

Notes

1/ IR-8 (from IRRI).

2/ IR-8. In 1968, 210 tons of IR-8 were imported from the Philippines and 0.90 tons (0.45 IR-8 and 0.45 IR-5) from IRRI.

3/ In 1969, less than 0.1 ton of IR-20 was imported from IRRI.

4/ In 1970, less than 0.1 ton of IR-20 and 0.35 ton of IR-22 was imported from IRRI.

5/ IR-8. Of the total, 1,131 acres were planted in yala (summer) 1968 and 16,107 in maha (winter) 1968/69. In addition, the following areas were planted to other improved varieties: H (or hybrid) series, 1,020,000 acres; A-8 (a local pureline), 15,500; PTB (an Indian hybrid), 2,300.

6/ IR-8. Of the total, 10,000 acres were planted in yala 1969 and 55,100 in maha 1969/70. In addition, the following areas were planted to other improved varieties: H series, 1,054,000 acres; A-8 and PTB-16, 22,300.

7/ IR-8. Of the total, 22,940 acres were planted in yala 1970 (including 670 of IR-262), and 50,050 in Maha 1970/71. In addition, the following areas were planted to other improved varieties: H series, 1,010,850, acres; BG-11-11, 2,832 (maha).

References

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) Letter from H. L. Dwelly, Acting AID Representative, American Embassy, Colombo, October 2, 1969 (data supplied by Ministry of Agriculture and Food).

(4) Data supplied by Ministry of Agriculture and Food, Colombo, October 16, 1970 (forwarded by Michael H. Snyder, Assistant AID Representative, Colombo, October 21, 1970).

(5) Data supplied by the Ministry of Agriculture and Lands, Colombo, December 10, 1970 (forwarded by Snyder, December 14, 1970).

(6) Data supplied by the Ministry of Agriculture and Lands, Colombo, December 9, 1971 (forwarded by Snyder, December 13, 1971).

INDIA

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1964/65	-	1/ (1)	200	8/ (4)
1965/66	6	2/ (1)	17,650	9/ (1)
1966/67	80	3/ (1)	2,195,000	10/ (5)
1967/68	20	4/ (2)	4,408,000	11/ (5)
1968/69	-	5/ (3)	6,625,000	12/ (5)
1969/70	-	6/ (3)	10,729,000	13/ (6)
1970/71	-	7/ (3)	13,593,000	13/ (6)

Notes

1/ Taichung (Native) 1. Hereinafter noted as TN-1. Two kg. were taken to India in a suitcase by the manager of the National Seeds Corporation.

2/ TN-1. One ton was shipped by air freight from IRRI in June 1965. Another 5 tons were received by ship from Taiwan in October 1965.

3/ TN-1. Gift of Joint Commission for Agricultural Reconstruction in Taiwan.

4/ IR-8 (from IRRI). Ten tons were provided by the Ford Foundation and arrived in mid-December 1966. The other ten tons were provided by the Rockefeller Foundation and arrived in Calcutta in February 1967.

5/ Less than 0.1 ton of IR-5 from IRRI in 1968.

6/ Import of less than 0.1 ton each of IR 5-81 and IR 5-114 from IRRI in 1969. (Neither is an official variety, but rather a selection.)

7/ Import of less than 0.1 ton each of IR-20 and IR-22 from IRRI in 1970.

8/ ADT-27.

9/ Composed of 2,500 acres of ADT-27 and 15,150 acres of TN-1. Of the ADT-27 area, 15,000 were in the rabi (or winter season) and 150 in the kharif (or summer season).

10/ Composed of 937,000 acres in rabi season and 1,258,000 in kharif.

11/ Composed of 1,660,000 acres in rabi season and 2,748,000 in kharif.

12/ Composed of 1,935,000 acres in rabi season and 4,690,000 in kharif. Within the rabi season, IR-8 accounted for about 49% of the harvest, TN-1 22%, ADT-27 and others 28% (ref. 7).

13/ The distribution of this area by state was:

	1969/70	1970/71
Tamil Nadu	26%	28%
Uttar Pradesh	13	13
Andhra Pradesh	12	11
West Bengal	11	10
Other	38	39

References

(1) Carroll P. Streeter, A Partnership to Improve Food Production in India, The Rockefeller Foundation, 1969 or 70, pp. 26-29.

(2) Ibid.; letter from Streeter, April 14, 1970; letter from Randolph Barker, IRRI, March 31, 1970.

(3) Barker (October 1970).

(4) "Rice Crop Proves Tanjore Program's Worth," Foreign Agriculture, March 4, 1968, p. 7; Department of State Airgram A-44 from Madras, October 13, 1967.

(5) Foreign Agricultural Service Report IN0143 from New Delhi, October 20, 1970 (data from Directorate of Extension, Ministry of Food and Agriculture).

(6) "Report on Price Policy for Kharif Cereals for the 1971-72 Season," Agricultural Prices Commission, New Delhi, September 1971, Table 4.

(7) "Evaluation Study of High Yielding Varieties Programme, Report for the Rabi 1968-60 - Wheat, Paddy, and Jowar," Planning Commission, New Delhi, November 1969, p. 50.

Rice

INDONESIA

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1966/67	0.2 1/ (1)	
1967/68		
1968/69	1 2/ (2)	488,400 4/5/ (4)
1969/70		1,854,000 4/5/ (4)
1970/71	- 3/ (3)	2,303,400 4/5/ (4)

Notes

1/ 200 kg. (440 lbs.); introduced from IRRI in 1966. "There have been additional imports of small lots of seed but they have probably not exceeded one metric ton" (ref. 1).

2/ C4-63; developed at the College of Agriculture at the University of the Philippines; imported in first six months of 1968 (ref. 3).

3/ 100 kg. (220 lb.) each of IR-20 and IR-22 were introduced (in January 1969 and February 1970 respectively) with AID assistance.

4/ Bimas Baru, Bimas Baru Gotong Rojong, and Inmas Baru programs. Includes all improved varieties: IR-5 and IR-8 (known locally as PB-5 and PB-8), C4-63, and national improved varieties (Syntha, Remadja, Bengawan, Sigadis, and Dewi Rathi) (ref. 5). The U.S. AID Mission estimated in 1971 that the Philippine varieties made up about 20% of the total area while the national improved varieties composed the other 80% (ref. 5). Widespread use of the IRRI varieties began during the 1968/69 wet season (ref. 6) while C4-63 came into commercial plantings during 1969/70 (ref. 3).

5/ The seasonal distribution was as follows:

Crop Year	Dry	Wet	Total
1968/69	43,570	444,850	488,420
1969/70	757,380	1,096,640	1,854,020
1970/71	589,750	1,713,610	2,303,360

References

(1) Letter from Francis J. LeBeau, Chief, Agriculture Division, US/AID, Djakarta, September 30, 1969. (Data obtained from Ministry of Agriculture of the Government of Indonesia.)

(2) Barker, op. cit. (June 1969).

(3) James E. Hawes, "Rice in Indonesia," Agriculture Division, US/AID, Djakarta, May 1970, pp. 18, 19.

(4) "Rentjana Realisasi Luas Pertanaman, Hasil padi dan Kenaikan hasi padi per Hektar Bimas - Inmas. M.T. 1963/64 s/d M.T. 1971/1972," Badan Pengendali Bimas, Djakarta October 10, 1971. (Translated version provided by Anderson N. Renshaw, Agricultural Officer, US/AID, Djakarta.)

(5) Letters from Renshaw (ibid.), October 29, 1971, November 12, 1971.

(6) Kampto Utomo, "Indonesia," Regional Seminar on Agriculture: Papers and Proceedings, Asian Development Bank, Manila, 1969, p. 161.

LAOS

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1966/67	0.1 1/	(1)	900 4/	(3)
1967/68			3,000 4/	(4)
1968/69	6 2/	(1)	5,000 4/	(4)
1969/70			4,940 4/	(5)
1970/71	10 3/	(2)	132,500 4/5/	(6)

Notes

1/ IR-8. Imported from IRRI in 1966.

2/ Two tons each of IR-5 and IR-253 (a glutinous variety specifically bred to suit taste preferences in the upper Mekong River basin) were imported from Philippines in 1968. Two tons of IR-253 came from IRRI in 1968.

3/ IR-20 from commercial sources in the Philippines. In addition, less than 0.1 ton each of IR-20 and IR-22 were imported from IRRI.

4/ The seasonal distribution was as follows:

	Wet	Dry
1966/67	-	900
1967/68	500	2,500
1968/69	1,240	3,760
1969/70	1,235	3,700
1970/71	128,500	4,000

5/ Principally IR-253. The increase in the wet season figure is exceptionally large. It is possible that the previous wet seasons may have been underreported.

References

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) Department of State Airgram A-647 from Vientiane, August 15, 1969.

(4) Letter from Leroy H. Rasmussen, Agriculture Division, US/AID, Vientiane, September 12, 1969.

(5) Letter from Rasmussen, September 23, 1970.

(6) Department of State Telegrams from Vientiane: 00476, January 18, 1972; 00804, January 28, 1972.

Rice

MALAYSIA (WEST)

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1966/67	3	1/ (1)	104,450	4/ (3)
1967/68	3	2/ (1)	156,950	4/ (3)
1968/69			224,660	4/ (3)
1969/70			238,100	5/ (4)
1970/71	-	3/ (2)	327,100	6/ (4)

Notes

1/ IR-8. Imported from IRRI in 1966.

2/ IR-8. Imported from IRRI in 1967.

3/ Less than 1.0 ton each of IR-20 and IR-22 imported from IRRI in 1970.

4/ Includes a number of improved hybrids. The main variety is Mahsuri, which was introduced in January 1965. Other varieties are (a) Malinja, which was introduced in early 1950's; (b) Ria, a local name for IR-8, which was introduced in late 1966; and (c) Bahagia, which originated from the same parental cross as IR-5, and which was introduced in 1968. (Refs. 3 & 5.) The Ria area was estimated as follows: 1966/67, 6,000; acres; 1967/68, 8,000; 1968/69, 9,000.

5/ Varietal breakdown estimated as follows: Mahsuri 63%, Bahagia 14%, Ria 7% (16,050 acres), Malinja 5%, and others 11%.

6/ Varietal breakdown estimated as follows: Bahagia 50%, Mahsuri 40%, Ria 7% (7,000 acres), Malinja 1%, and others 7%.

References

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) Letter from Dale K. Vining, Agricultural Attache, American Embassy, Kuala Lumpur, September 4, 1969 (estimate made by attache's office).

(4) Letter from Vining, October 26, 1971 (official estimates from Malaysian Ministry of Agriculture).

(5) Foreign Agricultural Service Reports from Kuala Lumpur: AGR-40, March 2, 1964; AGR-36, January 1, 1965; AGR-7, August 19, 1966; AGR-69, September 10, 1968.

Rice

NEPAL

Crop Year	Quantity of Seed Imported	Area Planted or Harvested
	- metric tons -	- acres -
1968/69	60.6 1/ (1)(2)	105,100 4/ (2)
1969/70	75 2/ (2)	123,000 4/ (2)
1970/71	0.5 3/ (1)	167,600 4/ (2)

Notes

1/ Import of 60 tons of IR-8 from India and 0.6 tons of IR-5 from IRRI.

2/ Import of 75 tons of IR-8 from India.

3/ Import of 0.32 tons of IR-20 and 0.19 tons of IR-22 from IRRI in 1970. (Nepalese data list the quantities as 0.14 and 0.09 tons respectively; ref. 2.)

4/ All improved rice.

References

(1) Barker (October 1970).

(2) Letter from Dale G. Strong, Food and Agriculture Division, US/AID, Kathmandu, October 13, 1971 (data from Economic Analysis and Planning Division, Ministry of Food and Agriculture).

Rice

PAKISTAN

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
East				
1966/67	10	(1)	500	(2)
1967/68	1,500	1/ (1)(2)	166,000	(4)
1968/69			381,500	3/ (5)
1969/70	4.4	2/ (3)	651,700	3/ (6)
1970/71	1,800	2/ (3)	1,137,000	3/4/ (7)
West				
1966/67	2	1/ (1)	200	3/ (2)
1967/68	77	2/ (1)	10,000	1/ (2)
1968/69			761,000	4/ (2)(3)
1969/70			1,239,000	(4)
1970/71			1,548,000	5/ (5)

Other Seed Imports: East and West

The seed import data reported separately for East and West Pakistan in the table and in the following sections are not based on IRRI data (which do not differentiate between East and West). Exports made by IRRI are reported as follows:

Year	IR-8	IR-5	IR-20	IR-22	IR9-60
1966	*				0.22
1967	3.01				
1968	*	*	*		
1969	*	*	4.5 1/	*	

---

* Less than 0.1 metric ton.
1/ In addition, 4.4 tons were shipped from commercial sources.

Source: Randolph Barker, IRRI, October 1970.

It will be noted that the 50-ton import reported elsewhere as coming from IRRI in 1967/68 is not included in the IRRI data; the reason for this discrepancy has not been determined.

Notes

East

1/ IR-8. Planted during boro (winter) season. (Total seed imports for both East and West Pakistan in 1967 are uncertain: Philippine data (ref. 9) indicate 3,600 tons; the Pakistan data cited here indicate 1,550 tons. The reason for the difference has not been determined.)

2/ IR-20. Received from commercial sources in the Philippines.

3/ The approximate seasonal distribution of the IRRI varieties was:

Crop Year	Aus (spring-summer)	Aman (summer-fall)	Boro (winter)	Total
1968/69	- 21,500 -		360,000	381,500
1969/70	42,900	29,200	579,900	652,000
1970/71	79,900	199,800*	(937,200)	(1,137,000)

* 166,500 acres of which were IR-20. Details on the use of this variety are provided in ref. 11. Source: ref. 10.

4/ Subsequent unofficial estimates were lower; one suggested 815,000 acres (ref. 8).

West

1/ IR-8.

2/ IR-8. 50 tons were imported directly from Los Banos. Another 27 tons were forwarded from East Pakistan where they were produced during the 1966/67 season. See East Pakistan fn. 1.

3/ "Few hundred acres."

4/ Includes a "few thousand" acres of IR-6 in the Hyderabad region; this variety is expected to eventually replace IR-8 (ref. 6).

5/ Estimate by Office of U.S. Agricultural Attache, Islamabad.

References

East

(1) Letter from Leon F. Hesser, Assistant Director of Agricultural Policy, US/AID, Rawalpindi, October 9, 1969.

(2) Rice and Wheat in Pakistan, Spring Review (AID), March 17, 1969, pp. 2-5.

(3) Barker (October 1970). Also see Foreign Agricultural Service Report PK 1032 from Islamabad, May 14, 1971.

(4) "Country Field Submission: Pakistan, FY 1971," AID, August 1969, Appendix A, Table 1; letter from Carl O. Winberg, Agricultural Attache, American Embassy, Rawalpindi, October 7, 1969.

(5) Foreign Agricultural Service Telegram TOFAS 96 from Rawalpindi, October 15, 1969 (official estimate by Government of Pakistan).

(6) "Notification," Government of Pakistan, Ministry of Agriculture and Works, Islamabad, November 11, 1970, p. 1. (Enclosure to Foreign Agricultural Service Report PK 0091 from Islamabad, November 24, 1970.)

(7) "Notification," Government of Pakistan, Ministry of Agriculture and Works, Islamabad, October 9, 1971, p. 1. (Enclosure to FAS Report PK 1091 from Islamabad, October 18, 1971.)

(8) Foreign Agricultural Service Telegram TOFAS 02 from Islamabad, January 5, 1972.

(9) Barker, op. cit. (June 1969).

(10) Department of State Airgram TOAID A-461 from Rawalpindi, September 16, 1970 (PROP), pp. 5, 6, 13; Foreign Agricultural Service Report PK 1048 from Islamabad, June 16, 1971.

(11) Foreign Agricultural Service Report No. PK 1035 from Islamabad, May 21, 1971. (Enclosure by Refugio I. Rochin on "Farmer's Experiences with IR-20 Rice Variety and Complementary Production Inputs: East Pakistan, Amon-1970," May 1971, 35 pp.)

West

(1) "Rice and Wheat in Pakistan," op. cit., pp. 16-17.

(2) Letter from Hesser, op. cit. (Oct. 1969).

(3) Telegram TOFAS 96, op. cit. (Oct. 1969).

(4) "Notification," op. cit. (Nov. 1970).

(5) Telegram TOFAS 02, op. cit. (Jan. 1972).

(6) Foreign Agricultural Service Report PK-9095 from Rawalpindi, August 5, 1969.

PHILIPPINES

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1966/67	55.3 1/	(1)	204,100	
1967/68	6.1 2/	(1)	1,733,400 6/	(4)
1968/69				
1969/70	18.2 3/	(1)	2,500,000 7/	
1970/71	- 4/	(2)	3,345,600 8/	(5)
	34.4 5/	(2)	3,868,100 9/	(5)

Notes

1/ IR-8. Purchased from IRRI in July 1966 and planted in dry season in late 1966 and early 1967.

2/ 5.2 tons IR-8 and 0.9 tons IR-5 (from IRRI).

3/ 0.1 tons IR-8 and 18.1 tons IR-5 (from IRRI).

4/ Less than 0.1 ton each of IR-8, IR-5, IR-20, and IR-22 from IRRI in 1969.

5/ Composed of 9.5 tons of IR-20 and 24.9 tons of IR-22, both provided by IRRI in 1970. In addition, less than one ton each of IR-8 and IR-5 were also provided by IRRI in 1970.

6/ Bureau of Agricultural Economics data. The total was broken down as follows: IR series, 1,082,000 acres; BPI series, 629,000; C series, 9,000. The BPI series was developed by the Bureau of Plant Industry of the Philippine Government; it is not as high yielding as the other two series. The C series was developed by the College of Agriculture at the University of the Philippines.

7/ Unofficial estimate. The estimate of the Bureau of Agricultural Economics was 3,155,000 acres (ref. 5), but this seems too high in terms of (a) the figures for the previous and subsequent year (the area devoted to HYV's was to have increased about 20% in 1969/70; ref. 7), and (b) another estimate available for the same year (the National Food and Agricultural Council placed the area at 1,482,600 acres (ref. 6), or 41% less than the area reported in the table and 53% less than the BAE figure just noted). The BAE figure was broken down as follows: IR series, 2,223,000 acres; BPI series, 723,000; and C series, 209,000.

8/ Bureau of Agricultural Economics data. The National Food and Agricultural Council places the area at 2,347,500 acres, or about 30% less (ref. 7). The BAE data were broken down as follows: IR series, 2,562,900 acres; BPI series, 283,200; and C series, 499,500.

9/ Preliminary Bureau of Agricultural Economics data. Typhoon damage in the fall of 1970 reduced production in Bicol and Southern and Western Mindanao.

References

(1) Barker (June 1969).

(2) Barker (October 1970).

(3) Rice in the Philippines, Spring Review (AID), March 3, 1969, section 2, p. 6, Appendix Table VIII-B. Data from RCPCC.

(4) Letter from Randolph Barker, IRRI, October 21, 1969.

(5) Telegram from Randolph Barker, IRRI, December 14, 1970; letter from Barker, December 15, 1970.

(6) Letter from John T. Hopkins, Assistant Agricultural Attache, American Embassy, Manila, September 25, 1970.

(7) Foreign Agricultural Service Telegram TOFAS 70 from Manila, December 3, 1970.

(8) Report of the Bureau of Agricultural Economics, Department of Agriculture and Natural Resources, Quezon City (forwarded by Barker, September 30, 1971).

VIETNAM (SOUTH)

Crop Year	Quantity of Seed Imported		Area Planted or Harvested	
	- metric tons -		- acres -	
1967/68	45	1/ (1)	1,200	6/ (1)
1968/69	2,005	2/ (1)	100,000	7/ (5)
1969/70	0.1	3/ (2)	498,000	(5)
1970/71	1.0	4/ (3)	1,240,300	(4)
1971/72	56.0	5/ (4)	(1,853,300)	8/ (4)

Notes

1/ IR-8; imported in October 1967. This shipment is noted in an AID report (ref. 1) but not in IRRI listings (which cite only shipments of less than 0.1 ton of IR-8 and IR-5; ref. 6).

2/ 2,000 tons of IR-8, 5 tons of IR-5. Barker indicates that the Philippines exported 1,807 tons of IR-8 and 205 tons of IR-5 to Vietnam (ref. 6). The reason for the difference in varietal composition is not known.

3/ 143 lbs. (65 kg.) of IR-20 received from IRRI in June 1969.

4/ IR-22 from IRRI, 1970. In addition, less than 0.1 ton of IR-20 seed was received from IRRI.

5/ Of this, 55 tons were IR-20 imported from the Philippines in March 1971 (50 tons were distributed to farmers in flood ravaged provinces; 5 tons were registered seed and were distributed for certified seed production) while 1 ton of RD-1 was imported from Thailand as a possible replacement for IR-5 (known locally as TN-5).

6/ Area planted. Only about 330 acres were harvested because of poor rains.

7/ The goal was 109,000 acres. Estimates of achievement range from 90 to 100%.

8/ Target. One third of this area is to be composed of IR-20 and IR-22 which show considerable promise as replacements for IR-8 (known locally as TN-8) (ref. 4).

References

(1) Rice in South Vietnam, Spring Review (AID), March 12, 1969 (TOAID A-1357), pp. 2, 8, 15, 16, 17.

(2) Agricultural Production Memo, Rice Series No. 117, Office of Domestic Production, US/AID, Saigon, January 6, 1970. Also noted in Department of State Airgram TOAID from Saigon, October 31, 1970, p. 5.

(3) Barker (October 1970).

(4) Agricultural Production Memo, Rice Series No. 140, Office of Food and Agriculture, US/AID, Saigon, May 25, 1971, pp. 1-5; letter from Ralph W. Clark, Agricultural Production Division, Office of Food and Agriculture, US/AID, Saigon, November 20, 1971.

(5) William J. C. Logan, "Changes in South Vietnamese Agriculture Raise Farm Production and Profits to New Levels," Foreign Agriculture, October 12, 1970, p. 9. (Slight adjustments in data in accordance with subsequent discussion with Logan.)

(6) Barker (June 1969).

PHILIPPINE AND IRRI EXPORTS OF HIGH-YIELDING RICE SEED TO COUNTRIES WHERE NO PLANTED AREA DATA ARE YET AVAILABLE

	1967	1968				1969			1970				
	IR-8	IR-8	IR-5	C4-63	C4-113	IR-8	IR-5	C4-113	IR-8	IR-5	IR-20	IR-22	C4-63
	- metric tons -												
ASIA													
Iran		#											
Iraq						100#							
UAR	100#												
Saudi Arabia		*											
Singapore									#	#			
Turkey		*	*			*							
AFRICA						*	*		*	*	0.1*	0.7*	
Ghana				2									
Ivory Coast		*	*							*	*	*	
Liberia		1#	1#	1#								0.5*	
		*										#	
LATIN AMERICA													
Colombia			*									*	
Ecuador			#			2.2#	#						
El Salvador												0.2*	
Nicaragua											*	0.3*	
Panama	10#	10*	#		#	#	#	#			33.5#	2#	33.5#
Venezuela		10#											

From commercial sources in Philippines; where used by itself indicates less than 1.0 metric ton.
* From International Rice Research Institute; where used by itself indicates less than 0.1 metric ton.

Source: Data provided by Dr. Randolph Barker, IRRI, October 23, 1970. No exports reported for 1971.

IV. SUMMARY OF ESTIMATED AREA

The overall area planted to high-yielding dwarf or semi-dwarf varieties of wheat and rice continued to expand sharply in 1970/71, reaching 50.5 million acres (20.5 million hectares), an increase of nearly 9.9 million acres or 24% over 1969/70. The increase was more marked for rice than for wheat; rice expanded by 6.2 million acres in 1970/71, while the comparable growth for wheat was 3.7 million acres. As a result, the total area planted to high-yielding varieties of rice in 1970/71 (25.3 million acres) equalled the wheat area (25.3 million acres). 1/

The regions covered by these figures were limited to non-Communist nations in Asia and North Africa (they exclude improved wheat areas in Egypt and Mexico and improved rice areas in Taiwan and for the H series in Ceylon 2/). Over half of the total area of both wheat and rice was in India. Pakistan was also a leader in both crops. Other nations with over one million acres were: (1) wheat, Turkey; 3/ (2) rice, Philippines, Indonesia, and South Vietnam.

Within individual countries, the proportion of total wheat or rice area planted to high-yielding varieties in 1970/71 varied sharply, ranging from highs of 49% for wheat in West Pakistan and 50% for rice in the Philippines to lows which were minor fractions. For Asia as a whole in 1969/70 (excluding Communist Asia), high-yielding varieties occupied about 20% of the total wheat area and 9% of the total rice area. 4/

Further details are provided in the four tables which follow. The data have been rounded to the nearest hundred.

1/ It should be recalled that the 1970/71 data are preliminary and are subject to revision.

2/ See discussion on pp. 2-3, 11, 28. As noted on p. 28, an additional 0.75 to 1.0 million acres of HYV rice were planted in Latin America in 1970/71.

3/ In Turkey, additional area was planted to HYV's of winter wheat.

4/ Estimates of the total areas in 1970/71 are not yet available.

Table A. HIGH-YIELDING WHEAT

	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71 1/
			- acres -			
South Asia						
Afghanistan	-	4,500	54,400	301,500	360,800	574,300
India	7,400	1,270,000	7,270,000	11,844,000	12,133,000	14,559,000
Nepal	3,500	16,200	61,300	132,900	186,600	242,700
Pakistan (E)	-	-	-	20,000	22,000	24,000
Pakistan (W)	12,000	250,000	2,365,000	5,900,000	6,626,000	7,288,000
West Asia						
Iran	-	-	-	25,000	222,400	321,200 2/
Iraq	-	-	15,800	103,000	482,400	309,000
Jordan	-	-	-	200	250	300
Lebanon	-	-	-	700	6,000	8,600
Syria	-	-	-	-	-	94,000
Turkey	-	1,500	420,000	1,444,000	1,343,000 2/	1,184,000 2/
Africa						
Algeria	-	-	-	-	12,400	346,000
Morocco	-	-	500	12,100	24,700 2/	49,400
Tunisia	-	-	2,000	32,000	131,000	255,000
Total	22,900	1,542,200	10,189,000	19,815,400	21,550,550	25,255,500

1/ Preliminary.
2/ Additional area planted to high-yielding winter wheat varieties.

Table B. HIGH-YIELDING RICE

	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71 1/
			- acres -			
South Asia						
Ceylon 2/	-	-	-	17,200	65,100	73,000
India 3/	17,700	2,195,000	4,408,000	6,625,000	10,729,000	13,593,000
Nepal	-	-	-	105,100	123,000	167,600
Pakistan (E)	-	500	166,000	381,500	651,700	1,137,000
Pakistan (W)	-	200	10,000	761,000	1,239,000	1,548,000
East Asia						
Burma 3/	-	-	8,500	412,400	355,900	496,300
Indonesia 3/	-	-	-	488,400	1,854,000	2,303,400
Korea (S)	-	-	-	-	-	7,200
Laos	-	900	3,000	5,000	4,900	132,500
Malaysia (W)	-	104,500	157,000	224,700	238,100	327,100
Philippines 3/	-	204,100	1,733,400	2,500,000 4/	3,345,600	3,868,100
Thailand 3/	-	-	-	-	-	400,000 4/
Vietnam (S)	-	-	1,200	100,000	498,000	1,240,300
Total	17,700	2,505,200	6,487,100	11,620,300	19,104,300	25,293,500 1/

1/ Preliminary. In addition, from 750,000 to 1,000,000 acres were planted in Latin America.
2/ Excludes improved local varieties (averaging about 1 million acres).
3/ Includes improved local varieties.
4/ Rough unofficial estimate (see text).

Table C. ESTIMATED TOTAL AREA OF HIGH-YIELDING VARIETIES OF WHEAT AND RICE

Crop Year	Wheat 1/	Rice 2/	Total
	-- acres (rounded) --		
1965/66	23,000	18,000	41,000
1966/67	1,542,000	2,505,000	4,047,000
1967/68	10,189,000	6,487,000	16,676,000
1968/69	19,815,000	11,620,000	31,435,000
1969/70	21,551,000	19,104,000	40,655,000
1970/71 3/	25,256,000	25,294,000	50,549,000 5/
	-- hectares (rounded) 4/ --		
1965/66	9,000	7,000	16,000
1966/67	624,000	1,014,000	1,638,000
1967/68	4,123,000	2,625,000	6,749,000
1968/69	8,019,000	4,703,000	12,722,000
1969/70	8,722,000	7,731,000	16,453,000
1970/71 3/	10,221,000	10,236,000	20,457,000

1/ Excluding Mexico. For coverage, see Table A.
2/ For coverage, see Table B.
3/ Preliminary.
4/ Conversions on basis of 1 acre = .4047 hectares.
5/ Wheat and rice do not add to total reported here due to rounding error (see 1970/71 totals in Tables A and B).

Table D. AREA DEVOTED TO HIGH YIELDING VARIETIES IN RELATION TO AREA OF ALL VARIETIES, 1970/71
(Preliminary; subject to revision)

	Area 1/		Proportion
	HYV	All Varieties	HYV
	- acres -		- percent -
WHEAT			
Afghanistan	574,300	(7,329,500) 3/	(7.8)
Algeria	346,300	7,400,000 2/	4.7
India	14,559,000	44,211,100	32.9
Iran	321,200	10,378,000	3.1
Iraq	309,000	5,023,500	6.2
Jordan	300	543,600	0.1
Lebanon	8,600	150,700	5.7
Morocco	49,400	1,230,600	4.0
Nepal	242,700	(959,000) 3/	(25.3)
Pakistan (E)	24,000	311,000	7.7
Pakistan (W)	7,288,000	14,976,000	48.7
Syria	94,000	930,000	10.1
Tunisia	255,000	1,816,200	14.0
Turkey	1,184,000	20,262,200	5.8
RICE			
Burma	496,300	12,295,000	4.0
Ceylon	73,000	(1,609,000) 3/	(4.5)
India	13,593,000	92,494,500	14.7
Indonesia	2,303,400	20,353,600	11.3
Laos	132,500	(1,900,000) 3/	(7.0)
Malaysia (W)	327,100	1,336,000	24.5
Nepal	167,600	(2,900,000) 3/	(5.8)
Pakistan (E)	1,137,000	24,494,000	3.3
Pakistan (W)	1,548,000	3,715,000	41.7
Philippines	3,868,100	7,691,300	50.3
Thailand	(400,000) 2/	18,779,600	(2.1)
Vietnam (S)	1,240,300	6,423,000	19.3

1/ Excluding Communist Asia.
2/ Particularly rough estimate.
3/ 1969/70 area.

Source: All varieties. From same source as HYV area or from recent reports by U.S. agricultural attaches. Figures in parentheses for previous years have been taken from Foreign Agricultural Service data.

VI. APPENDIX: RICE IMPROVEMENT IN COMMUNIST NATIONS

A. Mainland China

Mainland China has long been the world's largest rice producer. Accordingly, it has an extended history of rice improvement. 1/ As with other countries, much of this simply involved farmer selection of improved varieties which were then used locally.

Perhaps the most significant early step of which we have record took place around 1000 A.D. A new rice, known as Champa, was introduced from Indo-China into Fukien, and after 1012, into the lower Yangtze and lower Huai areas. Champa had several outstanding features; it was relatively early ripening (100 days after transplanting) and drought resistant. Although indigenous early-ripening rices had been in use previously, their adoption was very limited. Following the introduction of Champa, however, the use of early-ripening rice expanded, especially in southeast China. Other shorter season varieties were developed in the eleventh and twelfth centuries. By the early 1830's it is estimated that the area under early maturing varieties exceeded that under traditional types. While most were probably used for early season planting, thereby allowing double cropping, some were used to plant after severe droughts or floods. 2/

Both indica and japonica rices (see Chapter II) are found in Mainland China. Most of the varieties grown in southern China have traditionally been indicas. Both indica and japonica varieties have been reported growing in the area bordering the Yangtze River in central China. 3/

Irrigation and fertilization of rice have long been practiced in China. 4/ Through most of history, the fertilizers were organic products such as compost, green manures, oil meals, fish cakes, and night soil. The development of quick acting chemical fertilizers promised a much sharper boost for varieties which could respond to their application and yet not

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1/ Dwight H. Perkins, "Improved Seed," in his Agricultural Development in China, 1368-1968, Aldine, Chicago, 1969, pp. 38-41. Also see "Seed Selection" in Leslie T. C. Kuo, The Technical Transformation of Agriculture in Communist China, Praeger, 1972, Chp. 9, pp. 143-160.

2/ Ping-ti Ho, "Early Ripening Rice in Chinese History," The Economic History Review, December 1956, pp. 200-216. The origins of rice in China are discussed by Ho in "The Loess and the Origin of Chinese Agriculture," American Historical Review, October 1969, pp. 19-26.

3/ T. H. Shen, Agricultural Resources of China, Cornell University Press, 1951, p. 197.

4/ Perkins, op. cit., pp. 60-76.

lodge. 5/ Such fertilizers, however, did not begin to be very widely adopted in Mainland China until the 1960's. 6/

Stalk strength is a particularly important factor in the southern portions of China, especially in Kwangtung Province, because the early crop matures during the first part of the typhoon season. According to the Kwangtung Agricultural Science Academy, six strains of dwarf rice were successfully developed during the period from 1959 to 1963. 7/ Distribution of a dwarf "Nanteh" variety (I-geo Nan-teh) began in 1961. Large scale dissemination began in 1964 and it is claimed that nearly a million acres in Kwangtung, or about half the total early rice area, were sown to dwarf strains in that year. In 1965, the proportion increased to more than 80%. Today dwarf varieties are reportedly extensively used in all early rice producing provinces (the area of early rice accounts for about one quarter of the total rice output in China). 8/

A recent survey of Chinese agriculture broadcasts over Hanoi Radio stated that five provinces had "popularized cultivation of a kind of rice plant whose stalk is small, which has few leaves, will rarely collapse prematurely but whose production is high." 9/ A radio broadcast from Nanchang described a similar short-stemmed strain which produced twice the usual yields. 10/ Travelers to a commune in Kwangtung in December 1969 reported

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5/ In Japan, increasing application of commercial fertilizer (fishmeal, soybean cakes) in the late 1800's and chemical fertilizer in the early 1900's led to an early interest in the development of such varieties. One of the first was selected in 1877. (Takane Matsuo, Rice Culture in Japan, Yokendo Ltd., Tokyo, 1955, p. 13.)

6/ Perkins, op. cit., pp. 60-76. A new chemical fertilizer known as 702 has recently been popularized in Kwangtung Province ("702 - Chinese Puzzle," Economic Times of India, Bombay, November 3, 1970).

7/ By 1966, nine improved dwarf varieties had been introduced in Kwangtung (memo from T. T. Chang, International Rice Research Institute, October 20, 1970). It is reported that at least some of the short stalk strains were developed in eastern Kwangtung, a well-known high-yield rice area, from a parent species native to Fukien Province. Similarly, to the immediate north in Kiangsi Province, a short-stemmed rice (Bantam Nan No. 4) was introduced from Fukien in early 1964. Dee-geo-woo-gen, one of the parents of TN-1 and IR-8, is thought to have come from Fukien.

8/ Based on comments provided by Yueh Tung, Office of the Agricultural Officer, American Consulate General, Hong Kong, September 23, 1970.

9/ Tillman Durdin, "Chinese Report New Rice Strain," New York Times, October 26, 1969.

10/ "Two Big Harvests Reported in China," New York Times, November 19, 1969.

that a short rice crop had been planted and was very satisfactory. Record rice yields were reported obtained in China in 1969 and were attributed to the introduction of new varieties. 11/

It is a tantalizing question whether the IRRI varieties have played any role in recent Chinese developments. On one hand, the Chinese could well have developed their own high-yielding dwarf varieties without making use of outside seed stock. On the other hand, it would seem highly likely that the Chinese would have imported IR-5 and IR-8 for experimental purposes (even though south China might be too far north for optimum performance). The Chinese have said nothing on this question. 12/

Western news accounts are mixed. Several point out the similarities between the IRRI and Chinese varieties but go no further. 13/ Only one news account is known to have actually said that IR-8 is being used in China; it indicated that the Chinese began their first experiments with the seed in 1968 and then placed orders for seed through proxies in Nepal and Pakistan for spring planting in 1970. 14/

On balance, it would seem very likely that the Chinese have imported at least small quantities of IRRI seed. But whether the seed has been imported in large quantities and/or has had any significant impact to date is not at all certain and may never be. The more important questions, however, concern the increased yield potential and area devoted to the new varieties, whatever their origin. The quality of seed management is also an important factor.15/ We have little current information on these points.

11/ Ibid. No one variety has been named; it is likely that at least several are involved.

12/ Considerable official emphasis has, however, been placed on shortening the time involved in developing new varieties. Plant breeders have been sent to the countryside for "re-education." In the process, long-term breeding projects have likely been broken up. (See, for example, "Scientists Cultivate New Seed Varieties," New China News Agency, December 11, 1969; reported in FBIS, December 12, 1969.)

13/ One said in print that the Chinese were using the varieties but the author indicated that a typographical error was made in composing and a critical "not" was left out (Lee Lescaze, "Fat Grain Harvest Rewards Red China's Agricultural Push," Washington Post, August 2, 1970; letter from Lescaze, Hong Kong, September 7, 1970).

14/ Richard Hughes, "China Samples the Rockefeller Rice," London Sunday Times, February 15, 1970 (reprinted as "Superior Rice Strain is Sold to Red China," Chicago Tribune, May 6, 1970). Hughes subsequently indicated (September 21, 1970) that he had confirmed the report with a contact in Peking.

15/ See Kuo, op. cit., p. 150.

B. North Vietnam

Short-stemmed spring rice varieties were introduced to the mountain areas of North Vietnam from Mainland China during the Indo-China war. They were adopted because they could grow rapidly under rather hostile weather conditions. 1/ Following the departure of the French, these varieties reportedly began to move into the delta area. 2/ A 1970 broadcast on Hanoi Radio indicated that, while the spring rice had been transplanted for about 10 years, they were "not yet familiar with it." 3/

The spring crop has become increasingly important. In 1969, spring rice accounted for about 17% of the total area of the winter-spring rice crop (which in turn represents about 1/3 of the total annual rice area). By 1971 the proportion increased to nearly 60%. 4/ The actual area of spring rice has reportedly expanded as follows: 1968, 148,000 acres; 1969, 274,000; 1970, 500,000 (est.); and 1971, 1,360,000 (est.). 5/

While there are several spring varieties, two are of special interest: "Agricultural 8" and "Agricultural 5." According to a Vietnamese account in September 1969, "with the spring rice, we will be able to adopt many more valuable varieties such as Agricultural 8 and Agricultural 5, which ... we are growing experimentally over large areas." 6/ A subsequent newspaper account indicated that emphasis has been placed on IR-8; the seed was reportedly obtained "through Hong Kong and elsewhere." 7/

1/ "Spring Rice Has Good Prospects in Vietnam," Khoa Hoc Thuong Thuc (Hanoi, in Vietnamese), No's 321 and 323, February and March 1970 (JPRS 50693, June 9, 1970).

2/ Nguyen Van Luat, "Prospects for Short-Term Rice in Vietnamese Agriculture," To Quoc (Hanoi), September 1969, pp. 24-26 (JPRS 49482, December 19, 1969).

3/ "5th-Month and Spring Paddy Crops," Hanoi Domestic Service, September 17, 1970 (FBIS, September 22, 1970). Partially summarized in "Miracle Rice Narrows Food Gap in North Vietnam," The Sun (Baltimore), September 29, 1970.

4/ "5th-Month and Spring Paddy Crops," op. cit.; "Harvest Instructions," Hanoi Domestic Service, May 23, 1971 (FBIS, May 26, 1971).

5/ Van Luat, op. cit.; "Harvest Instructions," op. cit.

6/ Van Luat, op. cit.

7/ George McArthur, "N. Vietnam Reaping Record Rice Crop," The Washington Post, August 19, 1971, p. F2.

C. Cuba

IR-8 rice is widely planted in Cuba and evidently is doing quite well. Of 256,700 acres of rice planted in the "spring campaign" as of late May 1970, 91% was reportedly IR-8. 1/ Sinaloa A68, an IRRI selection from Mexico (see p. 10), is also grown.

Details for some of the leading regions follow. In the Jibaro area, about 30,000 acres (out of a total of 40,000) were sown to IR-8 in the spring of 1969. 2/ During the same season, IR-8 was "used in most of the planting" (which totaled 83,500 acres) in Oriente Province; 3/ similarly, in 1970 a good share of the rice fields in Oriente are planted in variety IR-8 from the Philippines." 4/ During the 1969/70 season, 66,400 acres were planted to IR-8 and 2,300 acres to IR-160 in Matanzas. 5/

It appears that Cuba originally obtained one kilogram of IR-8 seed from Mexico and did the multiplication job themselves. 6/ A Cuban newspaper account in December 1968 stated that the seed was obtained after much difficulty ("y que Cuba obtuvo venciendo innumerables difficultades"). 7/ Two Cuban officials visited IRRI in March 1969 and obtained small seed samples of 26 experimental lines. 8/ Production of certified seed was scheduled to begin during the winter of 1970/71.

1/ "The Spring Campaign Reaches 7,663 Caballerias of Rice," Granma (Havana, in Spanish), June 1, 1970.

2/ Aldo Isidron del Valle, "Rice Production to Increase in Jibaro Area," Granma, May 13, 1969, p. 5.

3/ Lenzano Paneque, "Oriente Rice Harvest," Granma, October 2, 1969, p. 1.

4/ Daniel Torres, "Rice in the Economic Program of Oriente Province," Havana Radio, January 1, 1970 (JPRS 49647, January 20, 1970).

5/ Juan Varela Perez, "How is the Rice Plan in Matanzas Going?" Granma, January 5, 1970.

6/ Letter from D.S. Athwal, Assistant Director, The International Rice Research Institute, May 21, 1971 (based on comments by Dr. R. F. Chandler).

7/ Rene Camacho Albert, "Rice Plan, Self Sufficiency in 1971 in Oriente," Granma, December 21, 1968, p. 5.

8/ Athwal, op. cit.

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